1,4-DICHLOROBENZENE

1,4-Dichlorobenzene is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 106-46-7

Molecular Formula: $C_6H_4Cl_2$

Atmospheric 1,4-dichlorobenzene is a result of the sublimation of 1,4-dichlorobenzene crystals. The crystals are white, volatile, non-corrosive, and have a penetrating odor. 1,4-Dichlorobenzene is slightly soluble in water, and soluble in carbon disulfide, chloroform, benzene, alcohol, and ether (Merck, 1989; HSDB, 1993).

Physical Properties of 1,4-Dichlorobenzene

Synonyms: p-dichlorobenzene; 1,4-DCB; paradichlorobenzol; Paracide; para-zene; di-chloricide; Paramoth; PDB

Molecular Weight:	147.01
Boiling Point:	174 °C at 760 mm Hg
Melting Point:	53.1 °C
Flash Point:	65 °C (closed cup)
Vapor Pressure:	0.923 mm Hg at 25 °C
Vapor Density:	5.08 (air = 1)
Density/Specific Gravity:	1.2475 at 20/4 °C (water = 1)
Log Octanol/Water Partition Coefficient:	3.39
Conversion Factor:	1 ppm = 6.01 mg/m^3

(Howard, 1990; HSDB, 1993; Merck, 1989; U.S. EPA, 1994a; CPA, 1996)

SOURCES AND EMISSIONS

A. Sources

1,4-Dichlorobenzene is used as a space deodorant and a dye intermediate (HSDB, 1991). As a registered insecticide, it is used for the control of lice and ticks in and around bird cages, for moth-and beetle-proofing in household dwellings, and in museums for the protection of insect, plant and stuffed animal collections (DPR, 1996).

The licensing and regulation of pesticides for sale and use in California are the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of 1,4-dichlorobenzene has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please contact the Pesticide Registration Branch of DPR (DPR, 1996).

The primary stationary sources that have reported emissions of 1,4-dichlorobenzene in California are coating and engraving metal manufacturing, crude petroleum and natural gas extraction, and sanitary services (ARB, 1997b). 1,4-Dichlorobenzene is a registered pesticide in California, and may be used for fumigations, landscape maintenance, and structural pest control, with approximately 37 pounds used in 1993 (DPR, 1995b).

B. Emissions

The total emissions of 1,4-dichlorobenzene from stationary sources in California are estimated to be at least 28,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

1,4-Dichlorobenzene does not naturally occur in the environment (Howard, 1990).

AMBIENT CONCENTRATIONS

1,4-Dichlorobenzene is routinely monitored by the statewide Air Resources Board air toxics network. The network's mean concentration of 1,4-dichlorobenzene from January 1996 through December 1996 is estimated to be 0.72 micrograms per cubic meter ($\mu g/m^3$) or 0.12 parts per billion (ppb) (ARB, 1997c).

The United States Environmental Protection Agency (U.S. EPA) has also compiled ambient concentration data from 55 locations throughout the United States. These locations reported mean concentrations that ranged from 1.04 $\mu g/m^3$ (0.17 ppb) in 1990 to 4.16 $\mu g/m^3$ (0.69 ppb) during 1976-86 (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

1,4-Dichlorobenzene is primarily used as a room deodorizer and for moth control. Volatilization from these products that are nearly pure 1,4-dichlorobenzene is the most significant indoor source.

Indoor residential concentrations of 1,4-dichlorobenzene have been measured in several studies. The California Total Exposure Assessment Methodology (TEAM) studies were conducted in 1984 and 1987 in and around Los Angeles and Contra Costa County. Mean indoor concentrations measured in the TEAM studies during the winter ranged from 20.2 to 36.2 $\mu g/m^3$, and 90th percentile values ranged from 68 to 159 $\mu g/m^3$. During the summer, concentrations were considerably lower with means ranging from 4.0 to 13.8 $\mu g/m^3$, and 90th percentile values from 7.84 to 23.0 $\mu g/m^3$. Indoor concentrations were generally about double the outdoor concentrations (Pellizzari et al, 1987b; 1989).

The most recent California study was conducted in Woodland, California, in the spring of 1990 (Sheldon et al, 1992). The mean concentration of 1,4-dichlorobenzene in 125 samples was 16 $\mu g/m^3$, with a range from below the quantifiable limit of 0.26 $\mu g/m^3$ to 300 $\mu g/m^3$. The mean from this springtime study lies between the summer and winter means measured in the earlier TEAM studies. Mean indoor concentrations from the Woodland study are approximately 50 times greater than the outdoor mean concentration of 0.3 $\mu g/m^3$ from the same study.

ATMOSPHERIC PERSISTENCE

1,4-Dichlorobenzene will exist in the atmosphere in the gas phase. The dominant tropospheric loss process for 1,4-dichlorobenzene is by reaction with the hydroxyl (OH) radical. Because of its reaction with the OH radical, 1,4-dichlorobenzene has a calculated half-life and lifetime of 1.0 months and 1.5 months, respectively (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program. Of the risk assessments reviewed as of April 1996, 1,4-dichlorobenzene and dichlorobenzene compounds were the major contributor to the overall cancer risk in 2 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million, and contributed to the total cancer risk in 34 of the these risk assessments. 1,4-Dichlorobenzene also was the major contributor to the overall cancer risk in 1 of the approximately 130 risk assessments reporting a total cancer risk equal to or greater than 10 in 1 million, and contributed to the total cancer risk in 2 of these risk assessments (OEHHA, 1996a).

For non-cancer health effects, 1,4-dichlorobenzene contributed to the total hazard index in 1 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. 1,4-Dichlorobenzene also contributed to the total hazard index in 1 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to 1,4-dichlorobenzene are inhalation, ingestion, and dermal contact (HSDB, 1991).

Non-Cancer: Inhalation exposure to 1,4-dichlorobenzene may cause skin, eyes, and respiratory tract irritation (Sittig, 1991). Long-term inhalation exposure may effect the liver, skin, and central nervous system in humans (U.S. EPA, 1994a).

A chronic non-cancer reference exposure level of 700 $\mu g/m^3$ is listed for 1,4-dichlorobenzene in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the gastrointestinal system and liver (CAPCOA, 1993). The U.S. EPA has established a Reference Concentration (RfC) of 800 $\mu g/m^3$ for 1,4-dichlorobenzene based on increased liver weights in male rats. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has not established an oral Reference Dose (RfD) (U.S. EPA, 1994a).

No information is available regarding adverse reproductive or developmental effects in humans. Mixed results were seen in two studies in test animals (U.S. EPA, 1994a).

Cancer: No information is available on the carcinogenic effects of 1,4-dichlorobenzene in humans. According to the U.S. EPA Integrated Risk Information System (IRIS) - 1996, 1,4-dichlorobenzene is not currently classified for carcinogenicity. The International Agency for Research on Cancer has classified 1,4-dichlorobenzene (paradichlorobenzene) in Group 2B: Possible human carcinogen (IARC, 1987a).

The State of California has determined under Proposition 65 that 1,4-dichlorobenzene is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 1.1×10^{-5} (microgram per cubic meter)$^{-1}$ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu g/m^3$ of 1,4-dichlorobenzene is estimated to be no greater than 11 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 4.0×10^{-2} (milligram per kilogram per day)$^{-1}$ (OEHHA, 1994).